U. S. DEPARTMENT OF AGRICULTURE
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VETCHES

VETCHES make excellent feed, either green or as hay, and are also exceedingly useful as cover and green-manure crops.

Vetches are usually seeded with enough small grain to make half a stand. Sixty pounds of common-vetch or 30 pounds of hairy-vetch seed are enough for an acre.

Inoculation is necessary for the successful growth of vetches and must be supplied where they are grown for the first time.

With seed at a reasonable price, hairy vetch is the best winter legume for all localities in the eastern half of the United States where red clover fails or where crimson clover is not a success.

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VETCHES.[1]

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COMMON VETCH.

COMMON VETCH, one of the two usually grown in the United States, is strictly an annual, having much the same habit as the garden or English pea, but the stems are more slender and usually taller, growing 3 to 5 feet or more in length. The leaves are pinnate, with about seven pairs of leaflets and a terminal tendril. The flowers are violet purple, rarely white, and borne in pairs on a very short stalk. The pods are brown and bear four or five seeds, which are marbled or mottled brown or gray in the commonest varieties. At maturity the pod valves split and coil readily, discharging the seeds. There are numerous varieties, distinguished mainly by the color and size of the seeds, such as gray vetch, brown vetch, pearl vetch. Pearl vetch has pinkish white seeds, often used as food after the manner of lentils. The brown-seeded varieties also are edible, but not so desirable. There are both spring and winter strains of common vetch, distinguished in European agriculture as spring vetch and winter vetch. Owing to the fact that the seed is grown largely in western Oregon, where it is usually fall sown, it has also become known as Oregon winter vetch. In contrast with hairy vetch, common vetch is also known as smooth vetch, and sometimes the name English vetch is applied to it. The gray-seeded variety of common vetch is the one most cultivated in the United States.

Common vetch is largely grown as a winter crop with oats or wheat for hay, and either alone or with oats for seed in western Oregon and western Washington, as a winter green-manure crop in the citrus districts of southern California, and as a winter crop, usually with oats, rye, or barley, in the Southern States. (Fig. 1.) As a spring-sown crop it succeeds only where the summers are fairly cool, as hot, humid weather is injurious to it. The winter strain of common vetch is ordinarily but little injured by a temperature as

[1] A revision and extension of Farmers' Bulletin 515, entitled "Vetches: With a Chapter on Vetch Seed and Its Adulterants," issued Nov. 11, 1912.

low as 10° F., but zero weather results in much winterkilling. Like other legumes, vetch is valuable for a variety of uses, such as hay, green feed, pasturage, silage, green manure, and seed.

SOIL REQUIREMENTS.

Common vetch does not thrive in poorly drained land. It does best in loams or sandy loams, though good crops are grown both on sandy and gravelly soils. On poor lands vetch is often used as a soil improver, and though the yield may not be large this is often good farm practice. On poor soils special care should be taken to provide thorough inoculation, as without it failures commonly result.

The seed bed for common vetch should be quite firm. For this reason it is a common practice in Oregon to broadcast the seed in

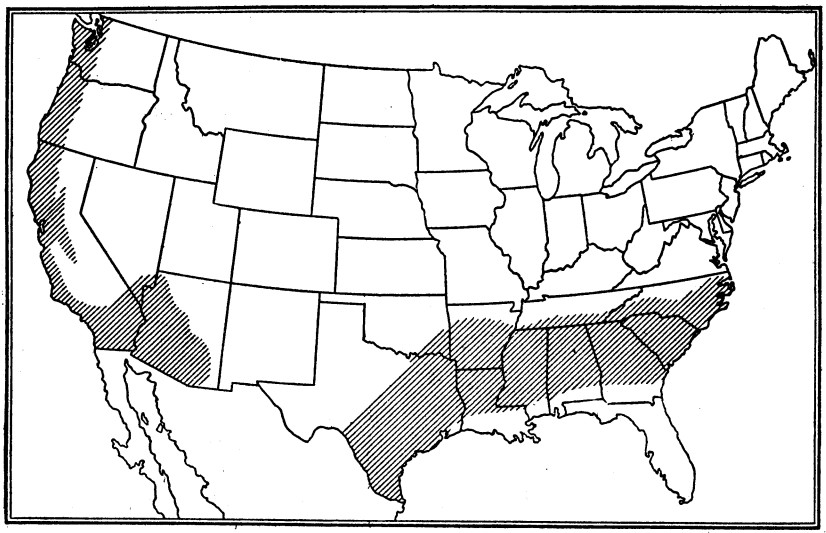

FIG. 1.—Map of the United States, showing the regions suited to the fall seeding of common vetch.

wheat or oat stubble and then go over it with an ordinary disk harrow, or if the land is fairly loose the seed is simply sown in the stubble with a disk drill. This method gives satisfactory results, especially if the previous small-grain crop has been spring sown and if the vetch is sown quite early in the fall. If the planting is done later or if the previous grain crop was fall sown, the land is usually too compact and thorough preparation of the soil is advantageous.

In the South special preparation of the soil before planting vetch is usually necessary. But few successes have thus far been noted from planting in cotton or some other cultivated crop, although where the soil is thoroughly inoculated this method has given excellent results.

METHODS OF SOWING.

Common-vetch seed may be sown either broadcast or by drilling. Broadcasting is the older method, but the use of the drill has greatly increased in recent years, especially in Oregon. Drilling has the ad-

vantage of being more economical in the use of seed. Some growers have contended that there is less winterkilling when the seed is drilled. However, experimental plantings have not shown this difference.

The depth of planting varies with the type of soil. In loam soils, good stands have been secured from plantings at a depth of 4 inches. Deeper plantings will usually result in poorer stands, while shallower plantings will give good stands when sufficient moisture is present. The surface moisture condition should determine the depth of planting, which should not exceed a depth of 4 inches.

Vetch may be sown alone or with one of the small grains as a supporting crop. To sow with grain has been and still is the commoner practice where the crop is grown mainly for hay, as the grain furnishes a support for the weak stems of the vetch and prevents lodging to a considerable extent. Oats are the favorite grain to use in combination with vetch, though wheat, rye, and barley may be used. Oats are preferred when the crop is grown for seed, as the oat seed can be readily separated from the vetch seed, while there is greater difficulty with rye, wheat, or barley. In Oregon vetch is sown alone to a considerable extent when grown as a seed crop, but the price charged for thrashing vetch alone in comparison with vetch in combination with oats or other grain is the determining factor in this practice. Where vetch is used mainly as a green-manure crop, as in southern California, it is nearly always sown alone.

TIME OF SOWING.

Common vetch is usually sown in the fall, from September till as late as December. In western Oregon and western Washington most of it is seeded in October, but a growing tendency is to seed it in September when weather conditions will permit, as the damage by winterkilling seems to be reduced by sowing at that time. Pearl vetch, which is less winter hardy, is planted toward the end of March, and it is not uncommon to plant common vetch at the same time. Indeed, some dairy farmers plant it at various dates, so as to use it to feed green. Sown with oats about October 1, it is ready to feed about May 1; planted later, it can be cut about June 1; and if early spring sowing, in February or March, is practiced, the vetch can be fed from June 15 to July 15. When cut early for soiling, a small second crop may be cut or used as pasture.

In southern California, when used for green manure, common vetch is sown in late August or early September, so that it can be plowed under by March.

In the Southern States, oats and common vetch should always be sown in the fall, October being the best month. Early fall planting gives the best results for green manuring.

Where the winters are severe, common vetch must be planted in the spring, but it is not often thus grown.

RATE OF SEEDING.

Common vetch when sown alone is most often seeded at the rate of 1 bushel (60 pounds) to the acre. This is sufficient to produce a perfect stand if there is no winterkilling. Thus, in Oregon it is the

common practice to sow 60 pounds of seed to the acre in the foothills where the drainage is good and the amount of winterkilling very small. If a mixture is sown, it varies from 30 pounds of vetch and 20 pounds of oats to double this combined quantity. In the valley lands, where a certain amount of loss is likely from winterkilling, especially if the soils become wet, a larger quantity of seed, namely, from 70 to 90 or even 120 pounds, is sown. If sown in combination with oats, 60 pounds of vetch and 40 pounds of oats are most commonly planted. The same rate of seeding is used as a rule whether the crop is grown for hay or for seed. Should the prospect be good for a high price for seed, the crop may be left to mature; otherwise it is cut for hay.

Some growers plant as high as 2 bushels of vetch to the acre when grown for seed alone. Such thick plantings stand up somewhat better, but the yield of seed will usually be reduced.

In California, when common vetch is planted as a green-manure crop the usual rate of seeding is 60 pounds to the acre, but as little as 40 pounds is sometimes sown.

In the Southern States there is nearly as much variability in the seeding rate as in Oregon; usually about 40 or 45 pounds of vetch and 1 to 2 bushels of oats are sown to the acre. A few growers plant only a thin scattering of oats, merely to help support the vetch.

INOCULATION.

In the Pacific Coast States vetch is nearly always naturally inoculated, the necessary bacteria apparently being present in the soil. Elsewhere in the United States it is essential that the soil be inoculated at the first seeding of the land to vetch. Many failures with this crop are directly attributable to the lack of inoculation. Inoculated plants are easily recognized by the nodules which form on the roots. A common result in such seedings is a spotted field. The healthy vetch plants will be in patches, and the remainder will turn yellowish and die. This is especially true in poor soil. If a spotted field is planted again the next season, it is practically certain that all the plants will be noduled and vigorous.

The surest method of inoculation is by scattering soil from an old vetch field or where vetch has been previously grown successfully. The soil should be broadcasted at the rate of 500 or more pounds to the acre and harrowed in at once. Care should be taken not to introduce diseases or troublesome weeds.

A method that often gives good results is to cover each seed with a coating of soil from a well-inoculated field. If the seeds are first moistened, preferably with a thin solution of glue, and then mixed with dry soil, each will become thoroughly coated. Such seed should be well dried again or else sown at once.

Where inoculated soil is not available, pure cultures may be used, but in this case it is advisable to plant but a small area the first time, and preferably on good or manured land; otherwise, there is considerable liability to failure due to lack of inoculation. A small successful patch will furnish an abundance of soil for inoculation the next season.

The same germ produces nodules on both common and hairy vetch, so that soil from either will inoculate the other.

WINTERKILLING.

The spring strain of common vetch often suffers much winterkilling when the temperature falls below 15° above zero Fahrenheit. The winter strain will stand from 5 to 10 degrees more of cold. Several factors, apart from the low temperature, contribute to the winterkilling. The amount of moisture in the soil, the natural drainage, and the time of seeding are factors having more or less effect. If rains immediately precede a freeze or the land is low or poorly drained, injury by frost heaving the soil is increased. Late seedings are injured more because the plants are small and tender, resulting often in poor or thin stands and correspondingly low yields of hay or seed. To offset this tendency some growers resort to heavy seeding, but where the winter is mild the resulting thick stand is detrimental to the yield of seed. It is generally recognized that early plantings are injured least, and an increasing tendency among vetch growers is toward earlier seeding.

HARVESTING FOR HAY.

Vetch should be cut for hay from the period of full bloom to last bloom when the first pods are well developed. It is commonly cut with an ordinary mower with a swather attachment, and the implement does satisfactory work. After cutting, the vetch should be bunched with a horserake and then shocked with pitchforks. This handling should always be done before the vetch leaves are dry. Vetch should be allowed to cure in the shocks several days, and, if possible, hay caps should be used if rainy weather is feared. Where a swather is not used, the harvesting is considerably more difficult. In either case it is the common practice to allow the vetch to lie one day before shocking.

It is sometimes desirable to pasture fall-sown vetch in the spring, so as to bring the haying season somewhat later and also to prevent heavy lodging. This is quite commonly done in western Washington and western Oregon.

Common vetch yields from 1½ to 3½ tons of hay to the acre. An average yield in the Pacific States is 2½ tons and in the Southern States somewhat less.

HARVESTING FOR SEED.

Common-vetch seed is produced in large quantities in the United States only in the Willamette Valley, Oreg. The methods of handling the seed crop vary, due partly to difference of opinion as to the best method, but more largely to the machinery available to the grower.

It is the general practice to cut vetch for seed as soon as the lower pods are fully ripe, at which time the upper pods will be fully formed and the plant will be carrying a maximum quantity of seed. Later cutting occasions more shattering of the seed, while earlier cutting results in a considerable percentage of immature seed. In a few places where but little seed is raised, the crop is cut with an ordinary mowing machine. Two men with pitchforks follow the mower and roll the vetch back from the uncut area, so as to enable the machine to get through when cutting the next swath. Sometimes

the first swath cut is rolled on the uncut vetch, and when the succeeding swath is cut the two are rolled back out of the way. This puts the vetch in larger swaths than the first-mentioned method and also somewhat reduces the loss from shattering. These two mower and pitchfork methods were formerly used generally, but now have been largely superseded by other methods.

An ordinary grain binder is used by some growers, especially when the vetch is short and therefore quite erect or when it is grown with a supporting crop, such as oats. When thus harvested, the crop is put in shocks similar to grain shocks and allowed to remain until threshed.

The most common way of harvesting vetch at present is to use an ordinary mower with a swather attachment. The swather, which is attached to and behind the sickle bar, rolls the vetch in a swath to the outside and leaves the way clear to cut the next swath.

Whatever method is used in cutting, the vetch is put at once into shocks and remains there till threshed. The most important rule in the growing of vetch seed is to handle the crop rapidly and as little as possible when cut.

Common vetch varies considerably in the yield of seed to the acre. Five bushels is considered a low yield, and 20 to 25 bushel yields are near the maximum. The average acre yield is probably from 10 to 12 bushels.

THRESHING.

Vetch is threshed with an ordinary threshing machine, but in order to reduce to a minimum the cracking of the seeds it is necessary to reduce the speed of the cylinder several hundred revolutions per minute and remove a number of the concave teeth. Common vetch threshes slowly, and consequently the expense is high. Sometimes the charge for threshing is by the bushel, but the more common practice is to thresh by the hour.

COMMON VETCH IN ROTATION.

In Oregon and Washington common vetch is usually grown after spring-sown oats. It is also used in rotation with potatoes or corn.

In the Southern States the crop is mostly grown in rotation with Johnson grass, this being especially true on valley lands where Johnson grass volunteers. Vetch, commonly mixed with oats or other small grain, is usually planted in October on well-prepared land and harvested by the middle of May. After the vetch crop is removed, the Johnson grass, more or less mixed with other grasses, begins to grow and commonly yields two hay cuttings during the season.

Where Johnson grass does not permanently occupy the land it is not advisable to sow it, as it is extremely difficult to eradicate. In this case various summer crops can be grown in the rotation, such as sorghum, cowpeas, sorghum and cowpeas combined, soy beans, velvet beans, or peanuts.

Common vetch is not well adapted to rotating with cotton unless used merely as a green manure. The vetch can not be harvested soon enough to permit the early planting of cotton, even when the seed is sown between the rows of cotton.

Common vetch is somewhat inclined to persist when once grown, especially where the winters are mild. Examples are known of its

reseeding itself in pastures for five years. In cultivated fields it volunteers readily, which is especially objectionable in wheat, owing to the difficulty of separating the vetch seed from the wheat. There is no danger of volunteer vetch unless a seed crop is grown or at least some of the seed allowed to ripen. In such cases, to avoid volunteer vetch the best plan is to follow with a crop of vetch and oats for hay, pasturing the stubble, so that no seed is allowed to ripen. A cultivated crop should be grown the next season, and then the land can be planted to wheat without danger of the vetch volunteering.

FERTILIZERS.

Information concerning the best fertilizers for common vetch is very limited. Barnyard manure is nearly always beneficial, and dairy farmers especially find it profitable to use on vetch fields.

In western Oregon it is a common practice to apply gypsum, or land plaster, and special machines are often used to apply it.[2] It is commonly applied at the rate of 75 to 150 pounds to the acre.

In the South a fertilizer containing phosphoric acid and potash is often used, a common rate of application being 200 pounds of acid phosphate and 100 pounds of muriate of potash to the acre. Lime is also used with beneficial results.

Nitrogenous fertilizers are seldom used, as inoculated vetch plants utilize the nitrogen of the air. By analysis vetch contains 2½ to 3½ per cent of nitrogen, much of which is from the air; in other words, a ton of dry vetch contains about 60 pounds of nitrogen. A considerable proportion of this nitrogen is returned to the soil when the crop is harvested as hay and fed on the farm.

PASTURING.

Common vetch is utilized by Oregon and Washington dairymen for pasturage during winter, spring, and early summer. It is eagerly eaten by all farm live stock. As a general rule, the vetch is pastured only when the ground is dry, not only to avoid packing the soil but because both cattle and sheep are liable to bloat on vetch, especially in wet weather.

Even when vetch is grown primarily for hay or for seed a limited amount of pasturing is often desirable, especially where the growth is unusually rank or where it is desirable to make the harvest later. Hogs should not be used for this purpose, as they kill out many of the plants by biting them off below the crown. Sheep and calves do the least damage in pasturing vetch designed for a hay or seed crop.

SOURCES OF SEED.

Common vetch seed has been extensively grown for some years in western Oregon, and practically all of this seed has been marketed on the Pacific coast. Were it not for high freight rates all of the seed used in the United States would be grown in this section. The price paid to growers has varied greatly, the maximum being about 8 cents a pound in 1919 and the minimum 1½ cents a pound in 1909.

[2] See Circular 22, Bureau of Plant Industry, U. S. Dept. of Agriculture, 1909, entitled "Farm Methods of Applying Land Plaster in Western Oregon and Western Washington."

Practically all of the common-vetch seed used in the Southern States in the past has been imported from Europe. Its wholesale price at European ports usually was from 2 to 2½ cents a pound and the freight to American ports about one-quarter of a cent a pound. More recently the wholesale price has ranged from 4½ to 7 cents a pound. The prices that American vetch-seed growers obtain are practically controlled by the price of imported seed.

TABLE I.—*Germination of seed of common vetch 18 months old compared with that 6 months old.*

Germinated on—	Germination (per cent).		Germinated on—	Germination (per cent).	
	Seed 18 months old.	Seed 6 months old.		Seed 18 months old.	Seed 6 months old.
Third day	91	68	Twenty-fourth day		2
Sixth day	3	12	Total germination	98	93
Tenth day	4		Hard Seed	2	6
Fourteenth day		11	Dead seed	0	1
Ninteenth day					

Common-vetch seed retains its vitality well for about four years, after which it begins to deteriorate. Fresh seed of common vetch usually germinates well, though it sometimes germinates slower than old seed and may contain a small percentage of hard seed. Table I shows the result of a test of seeds of common vetch of different ages made by Mr. Edgar Brown, Botanist in Charge of the Seed Laboratory, Bureau of Plant Industry. This seed was grown in western Oregon in 1910 and 1911. Table II shows the results of tests made at Corvallis, Oreg., by Mr. H. A. Schoth, of the Office of Forage-Crop Investigations, Bureau of Plant Industry, with seeds of different ages and grown in different years.

TABLE II.—*Germination of seed of common vetch of various ages grown in different years.*

Year in which seed was grown.	Germination and hard seed (per cent).							
	Seed 3 months old.		Seed 6 months old.		Seed 12 months old.		Seed 18 months old.	
	Germination.	Hard seed.	Germination.	Hard seed.	Germination.	Hard seed.	Germination.	Hard seed.
1915	100	0	98	1	99	1	99	0
1916	97	2	97	3	98	1	97	2
1917	97	3	100	0	100	0	100	0
1919	100	0						

USE AS GREEN MANURE.

Common vetch in the past has been employed extensively in the citrus districts of California as a green-manure crop. Its advantages lie not alone in the large tonnage that it yields, but also in the fact that it grows well in the cool weather of winter, permitting it to be plowed under early in spring. It is best sown in late August

or early September with irrigation, so that it can be plowed under in February and March,[3] which orchardists prefer.

It is also well adapted to similar use in the Southern States, but it is as yet not much utilized for this purpose.

HAIRY VETCH.

Hairy vetch is also known as sand vetch, Russian vetch, Siberian vetch, and villous vetch. Many American seedsmen advertise hairy vetch as "winter vetch," a term which European seedsmen use only for the winter strains of common vetch. As the term "winter vetch" is applied to two very different plants, it is best to avoid its use.

Agriculturally, hairy vetch differs from common vetch in being much more hardy and in acting as a biennial if planted in the spring. Botanically, it is easily distinguished by the narrower, more numerous leaflets, and the hairy, somewhat silvery, herbage. The flowers are blue-violet, borne in one-sided clusters of about 30 on a long stalk.

The pods of hairy vetch shatter much more easily than those of common vetch, and the seeds are smaller, globular, and nearly black.

CLIMATIC AND SOIL REQUIREMENTS.

Hairy vetch succeeds well wherever common vetch does and can be grown much farther northward, withstanding well the winters of eastern Washington, Michigan, New York, and even of New England. The proved superiority of New England home-grown seed as compared with the imported is perhaps due to increased hardiness. Success has been had with it in nearly every State of the Union, but it is likely to become of importance mainly where alfalfa and red clover do not succeed or do not meet the requirement of a short rotation.

Hairy vetch succeeds especially well on sandy soils, but can be grown on any well-drained land. It is markedly drought resistant, often making a good crop under dry conditions where common vetch fails. It is quite resistant to alkali and will germinate well in soils too alkaline for most legumes.

SOWING.

Hairy vetch withstands very cold weather and may be sown in midsummer in all Northern States. This is ordinarily the best time, but in the semiarid regions the soil-moisture conditions usually necessitate spring sowing. If the crop is to be kept on the land two seasons, the seeding in the Northern States should be in the spring. In other States early fall sowing is much better, as hairy vetch does not withstand severe summer heat. It may be sown either alone or with a small grain as a supporting crop. On sandy land, rye (Fig. 2) is the best grain to use, and in the North, where the winters are severe, either this or wheat must be used if the vetch is sown in the fall. The best time for seeding hairy vetch in the South is from August 15 to October 15.

[3] See Bulletin 190, Bureau of Plant Industry, U. S. Dept. of Agriculture, entitled "Orchard Green-Manure Crops in California," for a detailed description of the use of common vetch as green manure.

The seeds of hairy vetch are only about half as large as those of common vetch, and it is rare that more than 30 pounds to the acre are sown. Enough rye or other small grain to make a thin stand should be added, generally half a bushel to the acre.

No special preparation of the land is necessary for hairy vetch, but the seed bed should be well firmed. In periods of drought the seed may remain a long time in the soil and then germinate. The so-

FIG. 2.—Hairy vetch and rye growing together in Virginia.

called hard seed will remain a year or more in the soil without germinating.

Hairy vetch usually contains from 10 to 20 per cent of these hard seeds. They become germinable with age and consequently in time increase the total percentage of germination. The germinating power of hairy-vetch seed ordinarily does not begin to deteriorate until at least 5 years old; consequently, better germination is often secured in seed more than a year old than in new seed.

INOCULATION.

Inoculation of the soil when hairy vetch is planted for the first time is a matter of prime importance, as failure due to a lack of

the proper germs in the soil is a common experience. The surest method is to bring the soil from an old field of vetch, either hairy or common, scatter it over the field at the rate of 500 pounds to the acre, and immediately harrow it in. If screened, it may be sown with a drill. Where soil is not available, the artificial cultures may be used, but in this event only a small field should be planted, as the cultures do not always succeed and the risk is too great to warrant a farmer in planting a large field on land not inoculated. Where inoculation has once been successful it will not be necessary to inoculate in succeeding years. A partially inoculated field often has a spotted appearance when young, the healthy plants being green and the uninoculated ones yellow. If such a spotted field is planted again the following season it is practically certain that all the plants will be inoculated.

SOURCES OF SEED.

Before the war nearly all hairy-vetch seed was obtained from Russia. The wholesale prices at European ports then varied from 3 to 7 cents a pound, and in 1919 and 1920 the wholesale price of imported seed ranged from about 15 to 30 cents a pound. The grower in the United States has received from 6 to 21 cents a pound for his seed, the highest price being in 1919 and 1920.

In 1921 the price of vetch seed dropped decidedly, the grower receiving from 6 to 8½ cents a pound for hairy-vetch seed. In 1922 the price was much higher again, the grower receiving from 12 to 14 cents a pound. The importation of hairy-vetch seed was greatly reduced in the years from 1915 to 1919, when about a quarter of a million pounds were imported annually. From 1920 to 1922 there was a great increase again and over 1,000,000 pounds were imported each year. The annual production in the United States is about 1,000,000 pounds.

Hairy-vetch seed is grown in considerable quantities in Michigan, New York, Ohio, and Indiana in the North, and in small quantities in North Carolina, South Carolina, Georgia, Virginia, and other States in the South, and in western Oregon and western Washington. The seeds can be readily separated from oats, but it is much more difficult to separate them from wheat or rye.

Under very favorable conditions yields as high as 11 bushels to the acre have been obtained, but as a rule only 3 to 5 bushels are secured. There is no standard method of harvesting. The principles applicable to common vetch apply to hairy vetch, except that greater care is essential, because it shatters much more easily.

GROWING SEED FOR HOME USE.

Without doubt hairy vetch would be far more extensively employed as a crop if the seed were cheaper. There is little likelihood that European seed will ever reach the farmer at a satisfactory price, but seed can be grown readily in nearly every State in the Union at far less expense than it can be purchased.

At the Mississippi experiment station hairy vetch was harvested from the same piece of land five years in succession without resowing, enough seed shattering during harvest to produce a perfect stand. The only treatment has been to plow the land after harvesting the vetch and then sow to cowpeas. The cowpeas were cut for hay, after which the vetch quickly made a stand.

This plan is adapted to all the States south of the Ohio and the Potomac Rivers. Northward, the season is too short for the cowpeas, but long enough to grow a hay crop of millet.

Hairy vetch, when cut after some of the seed has matured, if not threshed for seed should be put in a barn with a tight floor as much of the seed will rattle to the bottom. Vetch that is cut so late is not of high feeding value, but the stock will eat much of it and the rest can be used as bedding. In taking out the straw from the mow care should be exercised to shake out any loose seeds it may contain. By this simple method a farmer can easily grow and save his supply of vetch seed at a low cost.

USES OF THE CROP.

Hairy vetch is adapted to nearly as wide a range of uses as red clover, and in regions where red clover for any reason does not succeed it is the best substitute. It makes excellent hay, though it is rather difficult to mow. An average yield is about 3 tons per acre. It furnishes pasturage of high quality and may be grazed somewhat in the spring without materially reducing the hay crop. When planted in the spring it will permit a large amount of grazing the first year and a full hay crop the next. As a winter cover crop it gives satisfaction if sown early, but it makes a slower growth in cold weather than common vetch.

It is the best winter green-manure and cover crop for tobacco fields in the Connecticut Valley.[4] It is well adapted to this purpose throughout the Northern States, and where neither red clover nor crimson clover succeeds is the best crop for this use, especially on sandy soils.

Where once established it is inclined to persist more or less from year to year as a weed. This is a serious matter in wheat-growing sections, as hairy-vetch seed is separated from wheat with difficulty. It is therefore seldom advisable to grow this vetch where wheat is produced. Its ability to persist, however, makes it useful in pastures, especially in the South.

HAIRY VETCH IN ROTATION.

Hairy vetch is very well adapted as a winter crop in the South to grow in rotation with such crops as cowpeas, soy beans, sorghums, millet, and late-planted corn. When Johnson grass occupies the land it is a common practice to plow and sow hairy vetch in the fall. Following its harvest, two crops of Johnson grass hay are usually cut.

It is also well adapted, like crimson clover, to plant in corn, and sometimes it is mixed with the clover. Hairy vetch will germinate under much more unfavorable conditions than crimson clover and often gives a stand when the clover fails. If thus sown it is best to mix rye with the vetch. It is not well adapted to plant in the rows of cotton, as it makes too little growth in winter to produce much green manure and can not be cut for hay soon enough to permit the early planting of cotton.

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[4] See Bulletin 149, Connecticut Agricultural Experiment Station.

In the Northern States hairy-vetch hay can be cut early enough to grow a crop of millet hay the same season.

Some of the less widely grown cultivated vetches are briefly discussed in the following pages.

NARROW-LEAF OR AUGUSTA VETCH.

Narrow-leaf vetch is very closely related to common vetch, but is distinguished by its narrower leaflets, smaller flowers, black pods, and round, smaller seeds. It is naturalized and thoroughly established in the Gulf Coast States and the Atlantic Coast States as far north as Maryland and occurs even as far north as Nova Scotia. It also occurs in abundance in Minnesota and in lesser quantity in Wisconsin and along the eastern edge of the Dakotas. In Georgia it is highly appreciated in the vetch-growing sections and sometimes makes up a considerable portion of the hay. It maintains itself from year to year by volunteering, when mixed with common vetch, as some seeds mature before the common vetch is ready to cut for hay. On pastures it remains as a permanent element and is highly appreciated.

The seed is now on the market in quantity. This seed is largely obtained from cleaning wheat in Minnesota, as narrow-leaf vetch occurs as a weed in the grain fields. Some is also imported from Europe.

Narrow-leaf vetch is a very valuable species and should be more largely grown in the South. Recently a variety has been discovered that does not shatter its seeds. This will be of value when it is desirable to grow a seed crop.

BLACK BITTER VETCH.

Black bitter vetch is grown in parts of Asiatic Turkey, whence seed has been shipped in quantity to England and other countries as feed for live stock, especially sheep. The price is variable, but the seed can be produced cheaply, owing to the erect habit of the plant and its great productiveness. The seeds are conical in shape and smaller than those of common vetch. Good stands are obtained with about 50 pounds of seed to the acre. Hay of this vetch is not readily eaten by live stock, but in California it has been found to be a good winter green-manure crop both on account of its erect habit and the large growth it makes in cool weather. Under California conditions it produces also good crops of seed, and can be grown to advantage when seed of other green-manure crops can not be secured cheaply.

PURPLE VETCH.

Purple vetch has much resemblance to hairy vetch, but it is an annual and the flowers are dark purple. It is slightly less hardy than common vetch. Its seed habits are excellent, and it can be grown about as cheaply as common vetch.

Seed is now produced in western Oregon, western Washington, and northwestern California. Purple vetch has proved exceedingly

satisfactory as a winter green-manure crop in southern California, and in the semiarid regions it has produced larger yields of hay from spring plantings than any other vetch.[5]

SCARLET VETCH.

Scarlet vetch is in general habit of growth like hairy vetch but is more nearly erect or ascending. It is characterized by its narrow leaflets and beautiful scarlet flowers in one-sided clusters. It is even less hardy than common vetch, but usually withstands the winters of the milder parts of the Pacific Coast and the cotton States. Only rarely does it produce seed abundantly, and the pods shatter readily, so that the seed is comparatively expensive. The plant is quite drought resistant, and has succeeded better in the semiarid regions from spring sowings than any other vetch except the purple. It is very doubtful whether the seed of this vetch will ever be cheap enough to compete with other varieties.

NARBONNE VETCH.

Narbonne vetch is in general appearance quite different from common vetch and hairy vetch. It has more erect and stouter stems, larger and fleshier leaflets, and larger seeds. It is not very hardy and turns black under severe summer heat. In the United States it is well adapted only to the Pacific Coast, and has no apparent advantage over common vetch while the seed is more expensive. Commercial seed comes from southern France and costs about 50 per cent more than common vetch.

HUNGARIAN VETCH.

Hungarian vetch is an annual. It is less viny than common vetch. Under good conditions the stems attain a length of 3 to 4 feet. The entire herbage is very hairy, giving the plant a silvery gray appearance. The leaves are linear and the flowers, which are cream or creamy white with few brown stripes, are borne in clusters of four, or sometimes less. It has succeeded well wherever tested and promises to be of especial value on poorly drained lands too wet for other vetches. It is more winter hardy than common vetch, but not as hardy as woolly pod and hairy vetch. Its seed habits are excellent and good crops of seed are being produced in western Oregon.

WOOLLY-POD VETCH.

Woolly-pod vetch is closely related to hairy vetch but is somewhat less winter hardy and ripens much earlier, maturing even before common vetch. It differs from hairy vetch in having finer stems, nearly smooth leaves, and reddish purple instead of bluish purple flowers. It bears odorous flowers in great abundance, attracting bees in large numbers. It has succeeded splendidly wherever tested and on account of the earliness and good seed-bearing qualities has

[5] See Farmers' Bulletin 967, U. S. Department of Agriculture, entitled "Purple Vetch," for a full description and discussion of this crop.

some advantages over hairy vetch. Excellent seed crops are produced in western Oregon, and the seed should become cheaper than hairy-vetch seed. It persists even more than hairy vetch and is already naturalized in western Oregon.

MONANTHA VETCH.

Monantha or one-flowered vetch is a small-leaved, weak-stemmed variety similar in general habit of growth and adaptations to hairy vetch and purple vetch. It is easily distinguished from other varieties by the bluish white flowers, which occur singly on long peduncles, and by the seed, which is mottled or occasionally black and decidedly flattened as in lentils. In the Gulf Coast States it is a promising substitute for hairy vetch as a winter cover crop. It does not withstand as low temperature as hairy vetch, but in mild winter weather it grows faster and is ready to plow under two or three weeks earlier. West of the Cascade Mountains in Washington and Oregon and the Sierra Nevadas in California on well-drained lands Monantha vetch is well adapted and makes excellent growth. It also makes good growth in the Gulf Coast States.

In tests at the Georgia Coastal Plain Experiment Station, Tifton, Ga., the growth of Monantha vetch on March 15 weighed green 19,000 to 20,000 pounds per acre. Hairy vetch on this date, which is the time farmers begin to prepare their land for cotton, weighed only 9,000 to 10,000 pounds per acre. Monantha vetch is a heavy seed producer on the Pacific coast, but only light crops of seed have been harvested in the Southern States. Seed production in the South is uncertain because of insect attack. Most of the commercial supply of seed is produced in northwestern California and western Oregon. A strong demand for the seed has grown up in Georgia, Alabama, and South Carolina within the last few years on account of its value there as a green manure and winter cover crop.

VETCH SEED AND ITS IMPURITIES.[6]

IMPORTANCE OF PROPER SEED.

Success with the vetches rests fundamentally on the use of proper seed. The seed should be true to name and free from adulterants and noxious impurities.

The adulteration and misbranding of vetch seeds, as defined by act of Congress, has been of frequent occurrence. Of 303 samples of seed purchased as hairy vetch in 1911, 62 per cent was found to be adulterated or misbranded. Examination of 391 samples submitted as hairy vetch in 1912 showed 53 per cent to be adulterated or misbranded. The substitution of common-vetch seed for that of hairy vetch constituted the misbranding. Hairy-vetch seed considered adulterated contained from 10 to 75 per cent or more of the seed of other kinds of vetch, including common vetch and wild kinds.

It therefore behooves the purchaser of vetch seed to investigate the character of the seed before sowing. The farmer can determine for himself the essential characteristics of vetch seed suitable to be sown.

[6] By F. H. Hillman, Assistant Botanist, Seed Laboratory.

EXAMINATION OF SEED.

From a practical standpoint the examination of vetch seed should determine the following questions:

(1) Is the seed common vetch or hairy vetch?
(2) Is old, dead seed present?
(3) Is other vetch seed or similar seed present?
(4) Is the seed mixed with low-grade screenings?
(5) Are specially noxious weed seeds present?
(6) Does a considerable part of the seed consist of hard seed incapable of prompt germination?

Purchasers of seed should have no difficulty in distinguishing the seeds of common and hairy vetches.

Seeds of common vetch (Fig. 3) average considerably larger than those of hairy vetch. They are slightly compressed, preventing them from rolling readily. The profile of most of the seeds is somewhat angular. The surface is more or less distinctly mottled, some of the seeds being uniformly light brown or greenish. The brightest seeds usually show three colors, light brown spotted with patches of

FIG. 3.

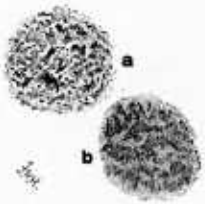

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 3.—Seeds of common vetch (*Vicia sativa*). (Natural size.)
FIG. 4.—Types of mottling of seeds of common vetch; *a* and *b*, from light and dark seeds, respectively. (Enlarged.)
FIG. 5.—Seeds of hairy vetch (*Vicia villosa*). (Natural size.)
FIG. 6.—Seed scar of common vetch. (Enlarged.)
FIG. 7.—Seed car of hairy vetch; *a* and *b*, forms showing the white, central slit of some scars. (Enlarged.)
FIG. 8.—Seeds of narrow-leaf vetch (*Vicia angustifolia*), a deceptive adulterant of hairy-vetch seed. (Natural size.)
FIG. 9.—Seed scar of the narrow-leaf vetch shown in Figure 8. (Enlarged.)

darker brown and further spotted or speckled with black (Fig. 4, *a*). Some seeds show but the two shades of brown (Fig. 4, *b*). In old seeds the general color is darker and the mottling is obscure.

Seeds of hairy vetch (Fig. 5) not only average smaller than those of common vetch, but they are nearly spherical and roll readily. The usual color of pure trade lots is grayish or leaden black. New seed is brown or greenish and often faintly mottled.

A conclusive distinction between the two kinds can be seen in the seed scars with the aid of a magnifier. The scar of common vetch (Fig. 6) is narrowly wedge shaped and has a slight ridge extending

lengthwise through the center. This ridge is usually lighter colored than the surrounding surface. In hairy vetch the scar (Fig. 7) is relatively broader, oval wedge shaped, and light brown or dark brown. There is no light-colored central ridge, but the scar is sometimes split along the center, producing a whitish line, as shown in Figure 7, *a* and *b*.

ADULTERATION OF HAIRY-VETCH SEED.

When one is familiar with the appearance of hairy-vetch seed and can recognize the seed by means of the scar as seen under a magnifier, the detection of other seeds used in adulteration is not difficult.

The most deceptive adulterant is the black seed of narrow-leaf vetch (Fig. 8), which, as seen with the naked eye, is almost identical with seed of hairy vetch. These seeds average somewhat smaller and usually have a slight luster. The seed scar (Fig. 9) is distinctly different from that of hairy vetch in being more nearly wedge shaped, black, and in having a slender but distinct ridge along the center, similar to that in the scar of common vetch. This vetch

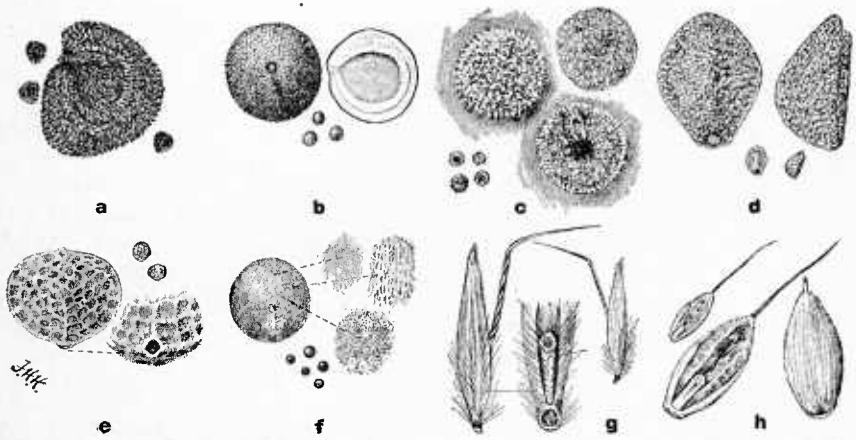

FIG. 10.—Common weed seeds in vetch seed: *a*, Corn cockle; *b*, cow cockle; *c*, cleavers; *d*, field bindweed; *e*, ball mustard; *f*, English charlock, or wild mustard; *g*, wild oats; *h*, darnel. (Enlarged and natural size.)

volunteers readily and usually constitutes a considerable proportion of low-grade hairy-vetch seed. Along with this black-seeded adulterant a considerable quantity of gray or mottled narrow-leaf vetch seed of similar size and shape is usually to be found. The lighter color of this seed aids in detecting the adulterant. Many lots of hairy-vetch seed consists largely of small-seeded common vetch, suggesting the use of screenings of this kind as an adulterant.

Misbranding usually consists in the substitution of common vetch for that of hairy vetch. This deception should readily be detected.

The use of old dead seed as an adulterant can be satisfactorily determined only by a germination test. Seed capable of prompt germination should mostly sprout within four or five days. Dead seed will become swollen and soft in this time, but will fail to sprout.

Mr. Edgar Brown, of the Seed Laboratory, finds that the difference in color of the interior of the seed shown by different kinds

of vetches affords a ready means of detecting the use of other vetch seed as an adulterant of hairy vetch. Crushed hairy-vetch seed is of a lemon-yellow color, somewhat lighter on the flat than on the rounded surface. The crushed seed of most of the other vetches occurring with the seed of hairy vetch varies in color from a dark fawn to reddish orange.

Crush a small handful of seed and if there are any fawn, salmon, or reddish orange colored pieces the seed is not pure hairy vetch.

WEED SEEDS IN VETCH SEED.

The use of low-grade screenings in adulteration usually introduces various weed seeds which are few or wanting in the best vetch seed. Some of these are generally recognized as noxious, and seed containing them should not be sown.

Corn cockle, or cockle, seeds (Fig. 10, *a*) probably are the commonest of the weed seeds with vetch seed, particularly with seed of hairy vetch. This seed is recognized by its spiny surface, angular form, and dark-brown or black color.

Cow-cockle seeds (Fig. 10, *b*), often referred to as cockle, differ from the preceding in being spherical and not spiny. They are black and about the size of the smallest hairy-vetch seeds.

The seeds of cleavers (Fig. 10, *c*) are somewhat hemispherical, the flattened face having a depression or cavity at the scar. The surface is roughened and gray or light brown. The gray color aids in distinguishing these seeds from vetch seed.

Field bindweed seeds (Fig. 10, *d*) are angular, brown or gray, the surface being finely roughened. They are similar in form to those of the morning-glory. They are not common in vetch seed except in low-grade lots.

Ball mustard seeds (Fig. 10, *e*) are inclosed singly in small straw-colored or brown net-veined pods. The pods are somewhat compressed and are about the size of the smaller hairy-vetch seeds.

English charlock, or wild mustard, seeds (Fig. 10, *f*) occur in some lots of poorly cleaned seed of hairy vetch. The charlock seeds are smaller than those of hairy vetch, and they are spherical, black or brown. They should not be confounded with the previously described cow-cockle seeds, which are larger.

Wild-oat seeds (Fig. 10, *g*) are similar to the seed of the cultivated oat, but can be distinguished by the cup-shaped scar at the base. This seed is either brown or straw colored. Some seeds have brownish hairs, and a twisted awn from near the middle is more or less evident.

Darnel seeds (Fig. 10, *h*) are similar to those of rye-grass, but are larger and heavier. The slender awn is often broken from the apex of the seed.

SUMMARY.

Common vetch is an annual legume extensively grown on the Pacific coast, to a less extent in the Southern States, and rarely in the Northern States. There are two important strains—winter vetch, sown in the fall, and spring vetch, sown in the spring.

Hairy vetch is a biennial species which is much more hardy. It is usually sown in late summer or early fall and can be grown in almost every part of the United States.

The seeds of common vetch are somewhat compressed and marbled or mottled brown or gray in most forms. Those of hairy vetch are smaller, globular, and black.

Vetches should not, as a rule, be sown in rotation with wheat, as they tend to volunteer and the seed is very difficult to separate from wheat. If grown in rotation with wheat they should not be allowed to mature seed, but where this is done they should be followed by a cultivated crop before wheat is again planted.

Vetches are weak stemmed and should generally be planted in a mixture with a small grain to support them.

Vetches make excellent feed, either green or as hay, and are also exceedingly useful as cover and green-manure crops.

Common vetch, even the winter strain, will not ordinarily withstand more cold than 15° above zero Fahrenheit, while hairy vetch is very hardy.

Common vetch requires fairly good soil to succeed, while hairy vetch is less particular and grows well in poor, especially sandy, land.

Common vetch will not grow in alkali soil nor is it drought resistant, while hairy vetch will stand considerable alkali and much drought.

Vetches are usually seeded with enough small grain to make half a stand. Sixty pounds of common-vetch seed are needed to the acre, or 30 pounds of hairy vetch.

Inoculation is necessary for the successful growth of vetches. This should always be supplied, if possible, where vetches are sown for the first time.

The grower has received from 1½ to 8 cents a pound for common-vetch seed and from 6 to 21 cents for the seed of hairy vetch.

Hairy vetch is perhaps the best legume to use where red clover fails, and this is especially true in sandy soils. In the Northern States it can be used to seed in corn at the last cultivation and will furnish a subsequent crop for green manure or hay.

The high price of the seed of hairy vetch is the principal reason why it is not grown extensively. Farmers can easily grow their own seed by devoting a special field to this purpose, as described on page 16.

Hairy vetch, with seed at a reasonable price, is the best winter legume for all localities in the eastern half of the United States where red clover fails or where crimson clover is not a success.

Common vetch does not withstand great summer heat and should not be planted in the spring in the eastern United States. It does succeed in the northernmost States when spring sown, but is usually not as desirable as field peas.

Seed of hairy vetch is sometimes adulterated, especially with that of common vetch and of wild vetches, and weed seeds are frequently present. Careful examination with the aid of the descriptions and illustrations in this bulletin will enable anyone to determine whether the seed is pure.

Several other species of vetch are grown to a limited extent. The purple and the black bitter vetches are proving to be excellent green-manure crops in California. Purple vetch is well adapted wherever common vetch will grow and is much more drought resistant. Woolly-pod vetch is similar to hairy vetch and much earlier, but is not so hardy, though more hardy than common vetch. Hungarian vetch is excellent on the Pacific coast and succeeds better than any other variety on poorly drained land. Narrow-leaf vetch is naturalized in the Atlantic Coast and Southern States and is valued as a constituent of pastures.

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March 15, 1930

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